AMENDMENTS TO THE CLAIMS

This listing of the claims will replace all prior versions, and listings, of claims in the application:

1. (Previously Presented) A spread spectrum communication system of the type that processes one or more spread-spectrum waveforms ("user spread-spectrum waveforms"), each representative of a waveform associated with a respective user, comprising:

a first logic element that generates a residual composite spread-spectrum waveform as a function of an arithmetic difference between a composite spread-spectrum waveform and an estimated composite spread-spectrum waveform,

one or more second logic elements each coupled to the first logic element, each second logic element generating a refined matched-filter detection statistic for at least a selected user as a function of

(i) the residual composite spread-spectrum waveform and

(ii) a characteristic of an estimate of the selected user's spread-spectrum waveform

wherein each second logic element comprises rake logic and summation logic which generates the refined matched-filter detection statistics based on the relation

$$y_k^{(n+1)}[m] = A_k^{(n)^2} \cdot \hat{b}_k^{(n)}[m] + y_{res,k}^{(n)}[m]$$

wherein

$A_k^{(n)^2}$ represents an amplitude statistic,

$\hat{b}_k^{(n)}[m]$ represents a soft symbol estimate for the k^{th} user for the m^{th} symbol period ,

$y_{res,k}^{(n)}[m]$ represents a residual matched-filter detection statistic for the k^{th} user, and

n is an iteration count.

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2. (Previously Presented) The system of claim 1, wherein the characteristic is at least one of an estimated amplitude and an estimated symbol associated with the estimate of the selected user's spread-spectrum waveform.

3. (Previously Presented) The system of claim 1, wherein the spread-spectrum communications system comprises a code division multiple access (CDMA) base station.

4. (Previously Presented) The system of claim 1, wherein the CDMA base station comprises one or more long-code receivers, and each long-code receiver generating one or more respective matched-filter detection statistics, from which the estimated composite spread-spectrum waveform is, in part, generated.

5. (Previously Presented) The system of claim 1, wherein the first logic element comprises summation logic which generates the residual composite spread-spectrum waveform based on the relation

$$r_{res}^{(n)}[t] \equiv r[t] - \hat{r}^{(n)}[t],$$

wherein

$r_{res}^{(n)}[t]$ is the residual composite spread-spectrum waveform,

$r[t]$ represents the composite spread-spectrum waveform,

$\hat{r}^{(n)}[t]$ represents the estimated composite spread-spectrum waveform,

t is a sample time period, and

n is an iteration count.

6. (Previously Presented) The system of claim 5, wherein the estimated composite spread-spectrum waveform is pulse-shaped and is based on estimated complex amplitudes, estimated delay lags, estimated symbols, and codes of the one or more user spread-spectrum waveforms.

7. (Canceled)

8. (Previously Presented) The system of claim 1, wherein the refined matched-filter detection statistic for each user is iteratively generated.

9. (Previously Presented) The system of claim 1, wherein the refined matched-filter detection statistic for at least a selected user is generated by a long-code receiver.

10. (Previously Presented) The system of claim 1, wherein the first and second logic elements are implemented on any of processors, field programmable gate arrays, array processors and co-processors, or any combination thereof.

11. (Previously Presented) A spread spectrum communication system of the type that processes one or more user spread-spectrum waveforms, each representative of a waveform associated with a respective user, comprising:

a first logic element which generates an estimated composite spread-spectrum waveform that is a function of estimated user complex channel amplitudes, time lags, and user codes,

a second logic element coupled to the first logic element, the second logic element generating a residual composite spread-spectrum waveform as a function of an arithmetic difference between a composite user spread-spectrum waveform and the estimated composite spread-spectrum waveform,

one or more third logic elements each coupled to the second logic element, the third logic element generating a refined matched-filter detection statistic for at least a selected user as a function of

(i) the residual composite spread-spectrum waveform and

(ii) a characteristic of an estimate of the selected user's spread-spectrum waveform

wherein the first logic element further comprises arithmetic logic which generates the estimated composite spread-spectrum waveform based on the relation

$$\hat{r}^{(n)}[t]=\sum_{r} g[r]\rho^{(n)}[t-r],$$

wherein

$\hat{r}^{(n)}[t]$ represents the estimated composite spread-spectrum waveform,

$p^{(n)}[t-r]$ represents an estimated composite re-spread waveform,

$g[r]$ represents a raised-cosine pulse shape.

12. (Previously Presented) The system of claim 11, wherein the characteristic is at least one of an estimated amplitude, an estimated delay lag and an estimated symbol associated with the estimate of the selected user's spread-spectrum waveform.

13. (Previously Presented) The system of claim 11, wherein the spread-spectrum communications system is a code division multiple access (CDMA) base station.

14. (Previously Presented) The system of claim 13, wherein the CDMA base station comprises long-code receivers.

15. (Canceled)

16. (Previously Presented) The system of claim 11, wherein the first logic element comprises arithmetic logic which generates an estimated composite re-spread waveform based on the relation

$$p^{(n)}[t] = \sum_{k=1}^{K_v} \sum_{p=1}^{L} \sum_{r} \delta[t - \hat{\tau}_{kp}^{(n)} - rN_c] \cdot \hat{a}_{kp}^{(n)} \cdot c_k[r] \cdot \hat{b}_k^{(n)}[\lfloor r / N_k \rfloor],$$

wherein

K_v is a number of simultaneous dedicated physical channels for all users,

$\delta[t]$ is a discrete-time delta function,

$\hat{a}_{kp}^{(n)}$ is an estimated complex channel amplitude for the p^{th} multipath component for the k^{th} user,

$c_k[r]$ represents a user code comprising at least a scrambling code, an orthogonal variable spreading factor code, and a j factor associated with even numbered dedicated physical channels,

$\hat{b}_k^{(n)}[m]$ represents a soft symbol estimate for the k^{th} user for the m^{th} symbol period,

$\hat{\tau}_{kp}^{(n)}$ is an estimated time lag for the p^{th}th multipath component for the k^{th} user ,

N_k is a spreading factor for the k^{th} user,

t is a sample time index,

L is a number of multi-path components.,

N_c is a number of samples per chip, and

n is an iteration count.

17. (Previously Presented) The system of claim 11, wherein the second logic element comprises summation logic which generates the residual composite spread-spectrum waveform that based on the relation

$$r_{res}^{(n)}[t] \cong r[t] - \hat{r}^{(n)}[t],$$

wherein

$r_{res}^{(n)}[t]$ is the residual composite spread-spectrum waveform ,

$r[t]$ represents the composite spread-spectrum waveform,

$\hat{r}^{(n)}[t]$ represents the estimated composite spread-spectrum waveform,

t is a sample time period, and

n is an iteration count.

18. (Previously Presented) The system of claim 17, wherein the estimated composite spread-spectrum waveform is pulse-shaped and is based on the user spread-spectrum waveform.

19. (Previously Presented) A spread spectrum communication system of the type that processes one or more user spread-spectrum waveforms, each representative of a waveform associated with a respective user, comprising:

a first logic element which generates an estimated composite spread-spectrum waveform that is a function of estimated user complex channel amplitudes, time lags, and user codes,

a second logic element coupled to the first logic element, the second logic element generating a residual composite spread-spectrum waveform as a function of an arithmetic difference between a composite user spread-spectrum waveform and the estimated composite spread-spectrum waveform,

one or more third logic elements each coupled to the second logic element, the third logic element generating a refined matched-filter detection statistic for at least a selected user as a function of

(i) the residual composite spread-spectrum waveform and

(ii) a characteristic of an estimate of the selected user's spread-spectrum waveform

wherein the second logic element comprises summation logic which generates the residual composite spread-spectrum waveform that based on the relation

$$r_{res}^{(n)}[t] \equiv r[t] - \hat{r}^{(n)}[t],$$

wherein

$r_{res}^{(n)}[t]$ is the residual composite spread-spectrum waveform,

$r[t]$ represents the composite spread-spectrum waveform,

$\hat{r}^{(n)}[t]$ represents the estimated composite spread-spectrum waveform,

t is a sample time period, and

n is an iteration count

wherein the estimated composite spread-spectrum waveform is pulse-shaped and is based on the user spread-spectrum waveform

wherein each third logic element comprises rake logic and summation logic which generates the second user matched-filter detection statistic based on the relation

$$y_k^{(n+1)}[m] = A_k^{(n)^2} \cdot \hat{b}_k^{(n)}[m] + y_{res,k}^{(n)}[m],$$

wherein

$A_k^{(n)^2}$ represents an amplitude statistic,

$\hat{b}_k^{(n)}[m]$ represents a soft symbol estimate for the k^{th} user for the m^{th} symbol period,

$y_{res,k}^{(n)}[m]$ represents the user residual matched-filter detection statistic for the m^{th} symbol period, and

n is an iteration count.

20. (Previously Presented) The system of claim 11, wherein the refined matched-filter detection statistic for each user is iteratively generated.

21. (Previously Presented) The system of claim 11, wherein the logic elements are implemented on any of a processors, field programmable gate arrays, array processors and co-processors, or any combination thereof.

22. (Currently Amended) A method for multiple user detection in a spread-spectrum communication system that processes long-code spread-spectrum user transmitted waveforms comprising:

generating a residual composite spread-spectrum waveform as a function of an arithmetic difference between a composite spread-spectrum waveform and an estimated composite spread-spectrum waveform,

generating a refined matched-filter detection statistic that is a function of a sum of a rake-processed residual composite spread-spectrum waveform for a selected user and an amplitude statistic for that selected user, and

determining one or more symbols transmitted by at least one of the users based on the refined matched-filter detection statistic,

wherein the step of generating the refined matched-filter detection statistic representative of that user further comprises performing arithmetic logic based on the relation

$$y_k^{(n+1)}[m] = A_k^{(n)^2} \cdot \hat{b}_k^{(n)}[m] + y_{res,k}^{(n)}[m]$$

wherein

$A_k^{(n)^2}$ represents an amplitude statistic,

$\hat{b}_k^{(n)}[m]$ represents a soft symbol estimate for the k^{th} user for the m^{th} symbol period,

$y_{res,k}^{(n)}[m]$ represents a residual matched-filter detection statistic, and

n is an iteration count.

23. (Original) The method of claim 22, comprising generating a refined matched-filter detection statistic that is a function of a sum of a rake-processed residual composite spread-spectrum waveform for a selected user and an amplitude statistic for that selected user multiplied by a soft symbol estimate.

24. (Original) The method of claim 22, further wherein the spread-spectrum communications system is a code division multiple access (CDMA) base station.

25. (Original) The method of claim 22, wherein the step of generating the residual composite spread-spectrum waveform further comprises performing arithmetic logic that is based on the relation

$$r_{res}^{(n)}[t] \equiv r[t] - \hat{r}^{(n)}[t],$$

wherein

$r_{res}^{(n)}[t]$ is the residual composite spread-spectrum waveform ,

$r[t]$ represents the composite spread-spectrum waveform,

$\hat{r}^{(n)}[t]$ represents the estimated composite spread-spectrum waveform,

t is a sample time period, and

n is an iteration count.

26. (Original) The method of claim 22, wherein the estimated composite spread-spectrum waveform is pulse-shaped and is based on a composite user re-spread waveform.

27. (Canceled)

28. (Original) The method of claim 22, the further improvement wherein the refined matched-filter detection statistic is generated by a long-code receiver.

29. (Currently Amended) A method for multiple user detection in a spread-spectrum communication system that processes long-code spread-spectrum user transmitted waveforms comprising:

generating a residual composite spread-spectrum waveform as a function of an arithmetic difference between a composite spread-spectrum waveform and an estimated composite spread-spectrum waveform,

generating a refined matched-filter detection statistic that is a function of a sum of a rake-processed residual composite spread-spectrum waveform for a selected user and an amplitude statistic for that selected user, and

determining one or more symbols transmitted by at least one of the users based on the refined matched-filter detection statistic,

wherein the step of generating the residual matched-filter detection statistic for an m^{th} symbol period comprises performing arithmetic logic based on the relation

$$y_{res,k}^{(n)}[m] = \mathrm{Re}\left\{\sum_{p=1}^{L} \hat{a}_{kp}^{(n)H} \cdot \frac{1}{2N_k} \sum_{r=0}^{N_k-1} r_{res}^{(n)}[rN_c + \hat{\tau}_{kp}^{(n)} + mT_k] \cdot c_{km}^{*}[r]\right\}$$

wherein

$y_{res,k}^{(n)}[m]$ represents the user residual matched-filter detection statistic for the m^{th} symbol period,

L is a number of multi-path components,

$a^{\wedge(n)H}{}_{kn}$ is the estimated complex channel amplitude for the p^{th} multipath component for the k^{th} user,

N_k is the spreading factor for the k^{th} user,

$r_{res}^{(n)}[t]$ is the residual composite spread-spectrum waveform ,

N_c is the number of samples per chip, and

$\hat{\tau}_{kp}^{(n)}$ is the time lag for the p^{th} multipath component for the k^{th} user ,

m is a symbol period,

T_k is a channel symbol duration for the k^{th} user,

~~c * km[r]~~ $\underline{c^*{}_{km}[r]}$ represents a complex conjugate of a user code comprising at least a scrambling code, an orthogonal variable spreading factor code, and a j factor associated with even numbered dedicated physical channels.

n is an iteration count.